DOCUMENT RESUME

ED 052 487 24g CG 006 496

AUTHOR	Aylmer, Robert C., Jr.
TITLE	Mediating Student-Computer Interaction: Access Routines in an Interactive Guidance System. Information System for Vocational Decisions.
INSTITUTION	Harvard Univ., Cambridge, Mass. Graduate School of Education.
SPONS AGENCY	Office of Education (DHEW), Washington, D.C.
REPORT NO	PR-22
BUREAU NO	BR-6-1819
PUB DATE	Nov 69
GRANT	OEG-1-6-061819-2240
NOTE	58p.
EDRS PRICE	EDRS Price MF-$0.65 HC-$3.29
DESCRIPTORS	Career Planning, *Computer Programs, Educational Technology, *Information Systems, *Man Machine Systems, *Occupational Guidance, *Programing Languages, Vocational Counseling, Vocational Development

ABSTRACT

The career decision making paradigm underlying the Information System for Vocational Development (ISVD) is briefly stated; it reflects the fact that a person has different information needs associated with different life stages, and with decision making stages within any given life stage. The greater portion of the report deals with the attempts, in Phase I and Phase II of the ISVD project, to make an interactive system which reflects this paradigm. Multiple avenues of access to the four major data files already developed are explained and sample interactions presented. Access routines, or scripts, are defined as programmed structures for interaction between an inquirer (user of the system) and the data files. (TL)

ED052487

INFORMATION SYSTEM FOR VOCATIONAL DECISIONS

Project Report No. 22

MEDIATING STUDENT-COMPUTER INTERACTION:

ACCESS ROUTINES IN AN INTERACTIVE GUIDANCE SYSTEM

Robert C. Aylmer, Jr.

This paper was supported in part by Grant No. OEG-1-6-061819-2240 of the United States Office of Education under terms of the Vocational Education Act of 1963.

Graduate School of Education
Harvard University

November 1969

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY

CG 006 496

MEDIATING STUDENT-COMPUTER INTERACTION:

ACCESS ROUTINES IN AN INTERACTIVE GUIDANCE SYSTEM

Robert C. Aylmer, Jr.
Graduate School of Education
Harvard University

The term "Access Routine" came into being quite early in the life of ISVD. At that time, the notion of computer-accessible data files existed, but the concept of "scripts", or programmed structures for interaction between an inquirer (user of the system) and data files for other system materials did not. The Access Routines were originally planned to do the work of transforming a computer with associated data files and retrieval software into what has been referred to as a "Guidance Machine" (Ellis, Pincus, and Yee, 1968). Such work was thought to consist of several interrelated functions:

A) To make the ISVD conducive toward the paradigm of career decision-making (Tiedeman and O'Hara, 1963) underlying the system;

B) To provide inquirers with variable modes of access to the data files and associated system components consistent with the paradigm; and

C) To "monitor" inquirers' decision-making behavior in the system, at first to provide data for inferences about individual inquirers, and eventually to provide inquirers with heuristics for making personally meaningful inferences about their own decision-making and career development.

This presentation is organized under these functional headings. It consists of two parts, the first describing work accomplished thus far, and the second presenting suggested revisions to system components based on excerpts from the field testing experience.

Part I:

Access Routines in ISVD Phase I

A. Decision-Making Paradigm

According to the model of decision-making and career development underlying the ISVD, individuals have different information needs at different stages in life, and at different states of decision-making within a given life range. An individual's career development is thought of as a series of discontinuities (periods in the life where some decision is necessary and perceived as necessary), in each of which there exist (or ought to exist) identifiable stages of decision-making behavior.

Discontinuities: Discontinuities arise as a result of joint influences on the individual from within [in the sense of perceptions, plans, and expectations about currently experienced and desired (future) situations], and from without (in the sense of societally determined statuses, assigned roles, and expectations for behavior). In this culture, most of us experience a predictable set and sequence of discontunities, such as choice of program in secondary, school post-secondary education and/or work, choice of college major and/or trial job(s), and choice of initial stable occupation(s). In addition, most of us create or encounter additional more or less idiosyncratic discontinuities, including post-graduate education, military specialization, specific vocational or professional training, shifts or revisions in the course of our working life. Such discontinuities mark the chief milestones in a career as it develops. Depending on the primary nature of the

discontinuity (occupational, educational, etc.), the individual has need of different categories of data.

Decision-Making Stages: As an individual proceeds through resolution of a particular discontinuity, culminating in the making and implementing of a specific choice, he is thought to go through several discrete stages of decision-making behavior. In the Tiedeman and O'Hara paradigm, these may be broken down into Exploration and Crystallization prior to Choice, Clarification subsequent to Choice but before implementation of the choice, and Induction, Reformation, and Integration following implementation. More generally, the first four states, Exploration through Clarification, may be thought of as stages of anticipation (in which a choice evolves and is planned for) and the last three as stages of accommodation (in which a particular choice is acted upon and its effects are experienced by the individual and by his environment).

While in an exploratory mode, a person's information need is primarily one of translating vague or uncertain feelings, evaluative attitudes, and perceptions of self and society into concrete vocational[1] possibilities within the range of possible alternatives.

As these vague preferences crystallize into criteria by which the individual evaluates vocational possibilities, the primary information need becomes one of more detailed knowledge about currently favored possibilities and about oneself, so that such criteria may be "tried out" against the environment, refined, and eventually lead to choice.

---

1. The concept of "vocation" as used here is a general one, incorporating the developmental aspects of an individual's educational, occupational, and personal-psychological status.

Once a choice has occurred, and is presumably being invested with commitment, a person is said to be in a stage of clarification with respect to his decision. At this stage, it is presumed that some information processing has gone on, in that the individual's choice represents an attempted integration of facts and data he has gathered during his activities. However, since information is rarely, if ever, complete, evolving commitment to a choice may be intermingled with a component of doubt, however, "good" or "appropriate" the choice may be judged by or for the individual. The primary task of the individual in clarification (and of any agent attempting to facilitate his decision-making) is to examine his commitment and doubt, to assess the strength of commitment to the choice, and to consider sources and implications of doubt coexisting with commitment.

This Janus-like emphasis on both past and future presents complex potential information needs. Consideration of sources of doubt and commitment involves re-examination of the decision-making activities leading up to choice, to identify themes and/or inconsistencies in the behavior and attitudes toward it. Such re-examination takes place primarily in relation to activities around the current choice, but may involve considerations of related patterns in other decisions as well. This recursive cycling through one's own decision-making activities as a source of self-knowledge can be considered a major component of what Shoben (1965) specifies as a major goal of guidance, i.e. living the "examined life."

Consideration of implications of the doubt and commitment aspects of the choice involves a focus on the future and unknown, so that desired situations can be brought about through planning and strategizing, and

contingencies may be anticipated and planned for. As increasingly specific plans evolve, and as goals become more clearly perceived, anticipations about oneself actually being in that situation become more focused.

Depending on the congruence between these anticipations and earlier expectations about goals, an individual might feel more strongly drawn to the choice, or draw back from it. In the latter case, he may recycle through the stages of anticipation, leading to a different choice, or he might reconsider the choice and maintain commitment to it, but with a different integration of doubt and commitment.

As the person comes to deal with the paradox of co-existing tentativeness (doubt) and commitment, several information needs may develop. He may seek out confirming evidence of his choice, and perhaps screen out potentially dissonant information. Alternatively, he might deliberately look for hidden flaws in his information or reasoning, in a sense playing "devil's advocate" with his own decision-making. Most frequently, however, he will probably consider the matter closed once he experiences a satisfying sense of commitment with a tolerable level of doubt. The degree to which any such strategy is followed will vary with individuals, and the task of facilitating agent will have to resonate with such idiosyncrasies.

Several types of information are necessary for clarification to lead to increased knowledge. Tiedeman (1969), adopting Landy's (1968) epistemology, has argued that indefinite, "private" knowledge has an important role in individual comprehension of development. Such knowledge, while not always open to conscious examination, is presumed to be

manifested in individual behavior, including decision-making behavior. In terms of information needs, an individual is potentially creating information about himself throughout the course of a decision, as his movements toward or away from alternatives, facts, and principles make more public, i.e. communicable, different aspects of his private knowledge. In terms of information needs accompanying clarifying decision-making activities, the focus is on examining the information generated by the person about himself in relation to a discontinuity as he proceeds through the anticipatory stages of a decision. The specifics of how this type of knowledge can be integrated with a guidance system are discussed more fully in the section of the report dealing with monitoring of decision-making behavior.

When commitment and tentativeness seem stabilized, or when external pressures (application deadlines, a job opening, a draft notice) dictate a need for action, emphasis within the decision shifts from choosing to actually implementing. Here, the plans and strategies for obtaining desired situations, which have existed as a background to earlier sorting and choosing activities, become figure as the individual moves to bring his developing decision into reality. Here, to a greater extent than before, reality considerations become salient, as the person is forced to relate his decision to the resources and opportunities available in his surroundings.

Finally, once a choice has been made and implemented, a person is potentially in contact with additional data, which arise out of his experiencing the effects of his implemented choice, as contrasted to his expectations about what those effects might be. His experience of

accommodation of himself and his environment with his choice and the anticipations which led him to choose it, can increase both his present comprehension of the choice, and potentially then the accuracy and comprehensiveness of his future anticipations about choices.

B. System Access

The above discussion has presented the decision-making paradigm underlying the ISVD in terms of information needs associated with different life stages (discontinuities) and with decision-making stages within any discontinuity. This section of the report describes initial attempts to make an interactive system reflect this paradigm.

In the prototype version of ISVD, data files have been designed to cover a broad range of frequently encountered discontinuities. At present, there are four major or "primary" data files: Occupational, Educational, Inquirer Characteristics, and Military, the Educational data file being further subdivided into the categories Junior High School, Senior High School, College, and Trade School.

In developing multiple avenues of access to these data files, several attempts have been made to reflect the information needs associated with different decision-making stages.

The exploratory information need has been met primarily through the creation of "preference scripts" tailored to the particular data files. Each data file (except Inquirer Characteristics) has associated with it one or more preference scripts which suggest specific possibilities to the inquirer on the basis of his evaluations about factors he wishes to consider and about specific levels within factors. The following is a sample interaction with the college preference script:

College Preference Script

System: WHAT WOULD YOU LIKE TO DO?

Inquirer: Choose a college

System: YOU ARE NOW BRANCHING TO THE EDUCATION SECTION.
YOU HAVE TAKEN THE COLLEGE PREFERENCE BEFORE, SO THE QUESTIONS WILL BE FAMILIAR AND YOU CAN ANSWER QUICKLY. YOUR LAST SET OF ANSWERS WILL APPEAR SO YOU WILL BE REMINDED OF WHAT YOU SAID BEFORE.
THERE ARE MANY FACTORS THAT WILL HELP US LOCATE COLLEGES IN WHICH YOU MIGHT BE INTERESTED. SOME OF THEM APPEAR IN THE INTERVIEW WHICH FOLLOWS, AND SOME WILL DEPEND ON WHAT FACTORS ARE IMPORTANT TO YOU IN CHOOSING A COLLEGE.
BASED ON YOUR ANSWERS, THE COMPUTER WILL FINALLY PRINT OUT A LIST OF COLLEGES IN WHICH YOU MIGHT BE INTERESTED. YOU MAY EITHER STOP THE INTERVIEW AT THAT POINT, OR GO ON TO FIND OUT SPECIFIC FACTS ABOUT THE COLLEGES LISTED.
LET'S BEGIN TO FIND OUT WHAT FACTORS ARE IMPORTANT TO YOU IN CHOOSING A COLLEGE.

Inquirer: (Pushes Send Block, the signal that he is ready to proceed)

System: THERE ARE, OF COURSE, MANY FACTORS THAT WILL INFLUENCE YOUR CHOICE OF COLLEGE. SOME THAT ARE GENERALLY CONSIDERED TO BE IMPORTANT WILL BE LISTED FOR YOU. PLEASE READ THE LIST. THEN TYPE THE LETTERS YOU THINK ARE IMPORTANT.
(PUSH "SEND BLOCK" TO CONTINUE.)

Inquirer: (Pushes Send Block)

System:
A. GEOGRAPHIC LOCATION (AREA OF THE U.S.),
B. PRIVATE, PUBLIC OR RELIGIOUS AFFILIATION,
C. SEX OF STUDENT BODY (ALL MEN, ALL WOMEN),
D. SIZE OF STUDENT BODY,
E. TYPE OF PROGRAM (FOR EXAMPLE, LIBERAL ARTS OR PREPROFESSIONAL),
F. AVAILABILITY OF FINANCIAL AID (LOANS AND SCHOLARSHIPS),
G. URBAN, SUBURBAN, OR RURAL ENVIRONMENT,
H. SPECIAL COURSES OF STUDY,
I. TYPES OF EXTRACURRICULAR ACTIVITIES AVAILABLE (ROTC, ATHLETICS, SOCIAL ORGANIZATIONS),
J. ACADEMIC STANDING OF PRESENT FRESHMEN (RANK).

Inquirer: A F J

System: GEOGRAPHIC LOCATION IS GENERALLY CONSIDERED TO BE AN IMPORTANT FACTOR IN COLLEGE CHOICE. YOU MAY ALREADY HAVE ONE OR TWO SPECIFIC AREAS IN MIND.

YOU WILL SEE A SLIDE OF THE VARIOUS GEOGRAPHIC AREAS OF THE COUNTRY. WE HAVE KEYED THE FOLLOWING LIST TO THAT MAP.

Inquirer: (Pushes Send Block)

System: NOW, USING THAT MAP, PLEASE TYPE IN THE LETTER OR LETTERS OF THE AREAS THAT APPEAL TO YOU.
PRESS THE RUN BUTTON NOW.
YOU BEGIN WITH 376 SCHOOLS.
A. NEW ENGLAND COLLEGES,
B. MIDDLE ATLANTIC COLLEGES,
C. MIDWESTERN COLLEGES,
D. SOUTHERN COLLEGES,
E. SOUTHWESTERN COLLEGES.

Inquirer: A B

System: A SOMETIMES IMPORTANT FACTOR IN CHOOSING A COLLEGE IS THE RELATIONSHIP OF COST TO THE AVAILABILITY OF SCHOLARSHIPS AND LOANS.
IN SOME CASES, FOR INSTANCE, IT IS POSSIBLE TO GO TO A FAR MORE EXPENSIVE COLLEGE THAN YOU CAN POSSIBLY AFFORD, IF YOU CAN WIN A SCHOLARSHIP OR GET ADDITIONAL LOANS FROM THE COLLEGE OR FEDERAL GOVERNMENT.
INDICATE WHETHER YOU ARE INTERESTED IN A FINANCIAL AID PROGRAM.
YOU HAVE 188 SCHOOLS LEFT.
A. FEDERAL LOANS
B. SCHOLARSHIPS
C. BOTH
D. AT LEAST ONE AVAILABLE
E. DOESN'T MATTER

Inquirer: D

System: ACADEMIC STANDING IS OF COURSE AN IMPORTANT CRITERION FOR CONSIDERING COLLEGES, ALTHOUGH IT IS NOT NECESSARILY THE MOST IMPORTANT.
ONE OF THE BEST WAYS TO USE THIS INFORMATION IN CHOOSING A COLLEGE IS TO LOOK AT SCHOOLS WHERE THE AVERAGE STANDING IS CLOSE TO YOUR OWN AT THIS TIME.
YOU HAVE 136 SCHOOLS NOW.

Inquirer: (Pushes Send Block)

System: IF YOU THINK THIS IS A GOOD WAY TO HELP SELECT YOUR COLLEGE, PLEASE TYPE IN THE LETTER CORRESPONDING TO YOUR PRESENT RANK IN YOUR CLASS. OTHERWISE PUSH SEND BLOCK.
A. TOP TENTH
B. TOP FIFTH
C. TOP QUARTER
D. TOP HALF
E. BOTTOM HALF

Inquirer: B

System: THERE ARE 28 COLLEGES ON THE LIST.
ON THE BASIS OF YOUR RESPONSES THESE ARE SOME COLLEGES YOU MIGHT CONSIDER. PUSH HARD COPY BUTTON IF YOU WISH.

COLBY COLLEGE
NEWTON JUNIOR COLLEGE
UNIVERSITY OF MASSACHUSETTS
BABSON INSTITUTE OF BUSINESS ADMINISTRATION
BOSTON COLLEGE
BOSTON UNIVERSITY
BRANDEIS UNIVERSITY
HARVARD UNIVERSITY
LASELL JUNIOR COLLEGE
LESLEY COLLEGE

Inquirer: (Pushes Send Block)

System: NOW WOULD YOU LIKE TO:
1. FIND OUT MORE ABOUT SCHOOLS ON YOUR LIST
2. DO THE INTERVIEW OVER AND CHANGE YOUR RESPONSES
3. DO SOMETHING ELSE
4. SEE MORE SCHOOLS ON THE LIST

The option of querying any of the data bases directly for general or specific information is always available to inquirers via a "command language." These commands, prefixed by a special code symbol, allow flow through the system and direct re-routing by the inquirer to the material of his choice. The full list of existing commands is:

@HELP	When you don't know how to answer a question
@STOP	When you want to go on to something else
@QUIT	When you want to leave ISVD entirely
@DATA	When you want to know about a specific college, job, trade school, or military job
@DATA-COL	When you want to know about a specific college
@DATA-JOB	When you want to know about a specific job
@DATA-TRADE	When you want to know about a specific trade school
@DATA-MIL	When you want to know about a specific military job
@SUMMARY	When you want a review of what you've been doing

The most powerful and potentially most useful of these commands is @DATA. It instructs the system that the inquirer desires certain information about some alternatives, and appropriate linkages to the data files are

set up. The inquirer has the option of adding a suffix to the command, including -JOB, for occupational information, -COL for colleges, -MIL for data about military service, or -TRA for trade schools.

If the inquirer does include a data file suffix, he branches directly to that file and is asked for the name of the job or school he wants information about and what type(s) of information he wants. He remains with this procedure until he opts out, and can change record names (specific jobs or schools) or variables (information categories, e.g. cost, or admission requirements of a college) at will. "Helping" scripts, designed to assist inquirers with requests for names or variables, are also available. A sample interaction with the college data file, including use of the HELPNAME script, follows:

Data Script

Inquirer: @DATA-COL

System: THIS IS THE FIRST TIME YOU HAVE USED THE DATA ROUTINE ACCORDING TO THE RECORDS. IF YOU ARE REALLY AN OLD HAND AND WOULD LIKE TO SKIP THE INTRODUCTION, TYPE SKIP. OTHERWISE, JUST PRESS SEND BLOCK.

Inquirer: (Presses Send Block)

System: ISVD HAS INFORMATION ABOUT JOBS, COLLEGES, TRADE SCHOOLS, AND MILITARY SERVICE. IN ORDER FOR YOU TO GET ANSWERS TO YOUR QUESTIONS ABOUT COLLEGES, THERE ARE A COUPLE OF GENERAL RULES TO FOLLOW. THE RULE THAT WILL PROBABLY BE MOST TROUBLESOME IS THAT TO GET INFORMATION ABOUT A COLLEGE YOU HAVE TO USE ITS CODE NUMBER OR SPELL IT OUT COMPLETELY. FOR INSTANCE, TO FIND OUT ABOUT BOSTON UNIVERSITY, YOU'D TYPE IN ITS CODE NUMBER 109 OR THE WORDS BOSTON UNIVERSITY. B.U. OR BU WOULDN'T WORK.

Inquirer: (Pushes Send Block)

System: BECAUSE OF THIS INCONVENIENCE, MOST OF THE SCRIPTS WHICH SUGGEST NAMES OF JOBS OR SCHOOLS TELL YOU TO MAKE A COPY OF

THE ONES YOU COME UP WITH. IF YOU DON'T HAVE A LIST WITH YOU, OR IF WE HAVE TROUBLE UNDERSTANDING YOUR REQUESTS, YOU CAN GET LISTS OF COLLEGES BY TYPING @HELP.

Inquirer: @HELP

System: IF YOU HAVE LEARNED HOW TO GET A NAME, YOU CAN TYPE SKIP AND THE EXPLANATION WILL NOT BE GIVEN.

Inquirer: (Pushes Send Block)

System: THIS ROUTINE IS INTENDED TO PROVIDE YOU A LIST OF COLLEGES YOU CAN TYPE IN. THE MACHINE ALREADY HAS ABOUT FORTY LISTS PREPARED. YOU MAY LOOK AT THE NAMES OF THOSE LISTS AND USE ONE. YOU CAN COMBINE VARIOUS LISTS, GETTING ALL COLLEGES THAT ARE ON BOTH LISTS, OR ON EITHER LIST OR ON ONE AND NOT THE OTHER. (MORE COMPLETE EXPLANATION IS GIVEN IF YOU CHOOSE TO COMBINE LISTS.) FINALLY YOU CAN CREATE YOUR OWN LIST BY STATING CRITERIA FOR SELECTING.

Inquirer: (Pushes Send Block)

System: DO YOU WANT TO
A. CREATE
B. SELECT
C. COMBINE
LISTS OF NAMES OR
D. SEE THE COLLEGES ON A LIST YOU ALREADY HAVE.

Inquirer: C Combine lists

System: TO BEGIN WITH, YOUR LIST CONTAINS ALL THE ITEMS. WHAT LIST DO YOU WANT TO COMBINE YOUR ORIGINAL LIST WITH?

Inquirer: What lists are there?

System: THE NAME WAS NOT RECOGNIZED. DID YOU SPELL CORRECTLY? YOU WILL KEEP CYCLING THROUGH THIS UNTIL YOU GET A CORRECT NAME OR TYPE @HELP. TRY AGAIN.

Inquirer: @HELP

System: THERE ARE LISTS WITH THE SCHOOLS CLASSIFIED BY SEVERAL KINDS OF FACTORS. FIRST CHOOSE A TYPE OF CLASSIFICATION FROM THE OUTLINE, THEN YOU WILL SEE ALL THE NAMES OF THOSE LISTS. YOU MUST TYPE THE EXACT NAME, SO MAKE A COPY OF THOSE THAT INTEREST YOU BY PRESSING HARDCOPY. THE FACTORS ARE: TYPE THE APPROPRIATE NUMBER.
1. GEOGRAPHICAL LOCATION
2. RELIGIOUS AFFILIATION
3. SEX OF STUDENT BODY

4. SIZE OF STUDENT BODY
5. AVAILABLE PROGRAMS OF STUDY
6. FINANCIAL AID
7. URBAN, SUBURBAN LOCATION
8. SPECIAL PROGRAMS
9. INTERDEPARTMENTAL PROGRAMS
10. EXTRACURRICULAR ACTIVITIES
11. RANK IN CLASS

Inquirer: 1

System: LOCATION
NEW ENGLAND COLLEGES
MIDDLE ATLANTIC COLLEGES
SOUTHERN COLLEGES
SOUTHWESTERN COLLEGES
WESTERN COLLEGES

Inquirer: (Pushes Send Block)

System: DO YOU WANT TO:
1. SEE ANOTHER CLASS OF LISTS
2. GO BACK TO WHAT YOU WERE DOING?

Inquirer: 2 Go back to what I was doing

System: WHAT LIST DO YOU WANT TO COMBINE YOUR ORIGINAL LIST WITH?

Inquirer: New England Colleges

System: WHICH COMBINATION DO YOU WANT?
1. AND (THOSE THINGS ON THIS AND THE PREVIOUS COMBINED LIST)
2. OR (THOSE ON THIS LIST OR ON THE PREVIOUS COMBINED LIST)
3. NOT (THOSE ON PREVIOUS LIST BUT NOT ON THIS ONE)

Inquirer: 1

System: THE LISTS ARE NOW COMBINED. THE COMBINED LIST HAS 176 ITEMS IN IT. YOU MAY NOW
1. COMBINE AGAIN
2. RETURN AND HAVE YOUR LIST PRINTED
3. START OVER MAKING A NEW LIST AND LOSING THIS ONE.
TYPE 1, 2, OR 3.

Inquirer: 2 Print my list

System: THE LIST WILL PRINT SEVERAL ITEMS AT A TIME, ASKING YOU IF YOU WANT MORE. YOU SHOULD PRESS HARDCOPY FOR A PERMANENT RECORD.
THIS RECORD HAS 123 COLLEGES IN IT.
CENTRAL CONNECTICUT STATE COLLEGE
DANBURY STATE COLLEGE

MANCHESTER COMMUNITY COLLEGE
SOUTHERN CONNECTICUT STATE COLLEGE
UNIVERSITY OF CONNECTICUT

Inquirer: (Pushes Send Block)

System: THIS RECORD HAS 123 COLLEGES IN IT. WOULD YOU LIKE TO
1. SEE THE NEXT ONES
2. SEE ANOTHER LIST
3. GET BACK TO REQUESTING DATA
TYPE THE NUMBER OF YOUR CHOICE.

Inquirer: 3

System: AFTER YOU TYPE IN THE NUMBER OR FULL NAME OF THE COLLEGE YOU'RE INTERESTED IN, WE'LL ASK WHAT YOU WANT TO KNOW ABOUT IT. AGAIN, IF YOU'RE NOT SURE WHAT SORT OF INFORMATION YOU WANT TO KNOW OR IF WE HAVE TROUBLE FIGURING OUT YOUR QUESTIONS ABOUT THE COLLEGE, TYPE @HELP.

Inquirer: University of Connecticut

System: WHAT DO YOU WANT TO KNOW ABOUT UNIVERSITY OF CONNECTICUT?

Inquirer: Location

System: COLLEGE = UNIVERSITY OF CONNECTICUT
VARIABLE = LOCATION
UNIVERSITY OF CONNECTICUT IS LOCATED IN STORRS, CONNECTICUT.

Inquirer: (Pushes Send Block)

System: WHAT DO YOU WANT TO KNOW ABOUT UNIVERSITY OF CONNECTICUT?

Inquirer: Cost

System: COLLEGE = UNIVERSITY OF CONNECTICUT
VARIABLE = COST
THE TUITION AT UNIVERSITY OF CONNECTICUT IS $190 FOR STATE RESIDENTS AND $400 FOR NON RESIDENTS.

A slightly different data access procedure is available whereby inquirers may receive more general descriptions of jobs or schools, rather than brief answers to specific questions. An illustration of this TEMPLATE routine, for jobs, follows:

Occupational Template

System: YOU WILL BE ASKED FOR AN OCCUPATIONAL TITLE. YOU MUST USE THE NAME PRECISELY AS WE HAVE IT RECORDED. IF YOU DO NOT KNOW ANY JOBS YOU COULD TAKE THE OCCUPATIONAL PREFERENCE SCRIPT WHICH WILL LET YOU SELECT A JOB WELL SUITED TO YOU. WOULD YOU LIKE TO TRY THAT SCRIPT?

Inquirer: No, I've just taken it.

System: YOU MAY NEED HELP GETTING THE NAMES CORRECTLY. WHEN YOU ARE ASKED FOR A JOB TITLE, YOU MAY TYPE @HELP, AND LEARN SOME NAMES THAT WORK. AFTER YOU TYPE A CORRECT JOB TITLE, YOU WILL SEE A BRIEF DESCRIPTION OF THE JOB. THEN YOU WILL BE ALLOWED TO ASK FOR FURTHER INFORMATION.

Inquirer: (Pushes Send Block)

System: THE AVAILABLE TOPICS ARE
REQUIREMENTS FOR THE JOB
WAGES AND BENEFITS
PERSONAL QUALITIES NEEDED
WORKING CONDITIONS
YOU MAY ASK FOR EACH IN TURN OR @STOP. FOR TECHNICAL REASONS THIS INFORMATION WILL BE COLD AND FORMAL. FOR THIS ISVD APOLOGIZES. AS TIME GOES ON, IMPROVEMENTS MAY BE POSSIBLE. MEANWHILE PLEASE REMEMBER THAT THIS INFORMATION IS INCOMPLETE. THERE IS MUCH MORE TO KNOW ABOUT A JOB THAN WHAT YOU SEE HERE. IF THE JOB INTERESTS YOU STRONGLY, SEE FURTHER INFORMATION...

Inquirer: (Pushes Send Block)

System: WHAT JOB DO YOU WANT DESCRIBED? YOU MAY TYPE THE NAME OF THE JOB OR ITS NUMBER.

Inquirer: Informal Waiter

System: AN INFORMAL WAITER IS A SERVICE WORKER. PRIMARILY, AN INFORMAL WAITER IS INVOLVED IN BUSINESS AND DOES CONCRETE AND ORGANIZED WORK. ON THE JOB WAITERS TAKE ORDERS AND SERVE FOOD AND BEVERAGES.

Inquirer: (Pushes Send Block)

System: IF YOU WOULD LIKE TO LEARN MORE ABOUT THIS JOB, PLEASE INDICATE A TOPIC THAT INTERESTS YOU. LATER YOU CAN PICK ANOTHER. OTHERWISE YOU MAY RETURN TO YOUR JOB LIST.

1. REQUIREMENTS FOR ENTRANCE AND ADVANCEMENT
2. WAGES AND BENEFITS
3. PERSONAL APTITUDES REQUIRED
4. WORK CONDITIONS AND OTHER DATA

5. TRY ANOTHER JOB
6. GO BACK TO WHAT I WAS DOING

Inquirer: 1

System: AN INFORMAL WAITER MUST AT LEAST COMPLETE JUNIOR HIGH SCHOOL AND SHOULD PREFERABLY GRADUATE FROM A VOCATIONAL HIGH SCHOOL. AFTER COMPLETING SCHOOLING AN INFORMAL WAITER USUALLY HOLDS ANOTHER JOB. PREVIOUS ACTIVITY MAY INCLUDE SPECIFIC TRAINING FOR THE JOB. UP TO 30 DAYS OF ON-THE-JOB TRAINING MAY BE INCLUDED. LOWER LEVEL JOBS LIKE BUSBOY MAY BE NECESSARY BEFORE BECOMING AN INFORMAL WAITER. HIGHER JOBS INCLUDE WAITER, FORMAL. NO INFORMATION AVAILABLE ABOUT ADVANCEMENT.

Inquirer: (Pushes Send Block)

System: A HIGH SCHOOL STUDENT INTERESTED IN BECOMING AN INFORMAL WAITER SHOULD TRY TO TAKE COURSES IN ENGLISH, SALESMANSHIP, SOCIAL STUDIES.

Inquirer: (Pushes Send Block)

System: IF YOU WOULD LIKE TO LEARN MORE ABOUT THIS JOB, PLEASE INDICATE A TOPIC THAT INTERESTS YOU.

Inquirer: 4 (Work conditions and other data)

System: OF ALL THE PEOPLE IN THIS OCCUPATION 70-95% ARE WOMEN. AS AN INFORMAL WAITER YOU WOULD PROBABLY NEVER TRAVEL OVERNIGHT OR LONG DISTANCES. IF YOU WERE AN INFORMAL WAITER YOU WOULD OFTEN WORK WEEKENDS. YOU WOULD OFTEN WORK NIGHTS. AN INFORMAL WAITER IS SOMETIMES REQUIRED TO GET A LICENSE. THERE IS NO INFORMATION ABOUT UNION MEMBERSHIP. AS AN INFORMAL WAITER YOU WOULD BE SUBJECT TO NO HAZARDS. IF YOU WOULD LIKE TO LEARN MORE ABOUT THIS JOB, PLEASE INDICATE A TOPIC THAT INTERESTS YOU.

Inquirer: 5 (I want to try another job.)

System: WHAT JOB DO YOU WANT DESCRIBED? YOU MAY TYPE THE NAME OF THE JOB OR ITS NUMBER.

Inquirer: Bridal Consultant

These preference and data access scripts were designed to meet information needs of inquirers at different life stages (by providing data about different common discontinuities) and at different stages within a particular discontinuity (by allowing access to the data files

in a browsing, perhaps undirected mode via preference scripts, and a more specific, purposeful way through direct data access).

Associated with these procedures, and overseeing interactions with the system, are "orientation scripts," which relate system components to inquirers' requests. These scripts begin with the question, "What would you like to do?", perform analyses on his natural language response, and branch him to appropriate sections of the system. If necessary, they elicit additional information from him about how he wants to use the system.

Orientation scripts consist of one major analyzing script and a set of minor scripts each associated with a specific data file. The function of the major script is to ascertain which primary data file is appropriate to the inquirer's intentions, and to call the minor script for that data file. The minor script re-analyzes the inquirer's statement, and attempts to determine which of the available materials in that data file the inquirer is requesting. Such decisions may be made solely dependent on explicit textual references contained in the inquirer's current statement, they may include requests for clarifying information from him about what he wants to do in the system, and/or they may be made contingent on the educational/vocational status of the inquirer or his history of prior interactions with the system.

C. Monitoring of Decision-Making Behavior[2]

Monitoring exists in different levels within the system. At a relatively basic level, the system keeps track of how often the inquirer

---

2. The procedures described below are all operational and are now included in the active system. However, many of them remained in preparation during the field test period, and therefore were used very infrequently or not at all by field test inquirers.

has been with the system, and how often he has used specific components. Such information is utilized in orientation scripts, as mentioned above, where branching logic can be made contingent on the inquirer's interactive history as well as current statements.

An inquirer's first contact with the system involves introductory scripts, which collect basic information from him and instruct him in the use of the system, as in the following example:

Introduction to the System

System: PLEASE TYPE YOUR ID NUMBER SO THAT YOU CAN BEGIN. PRESS THE BUTTON MARKED SEND BLOCK WHEN YOU FINISH. (IT'S ON THE RIGHT SIDE OF THE KEYBOARD.)

Inquirer: 0001

System: YOUR ID NUMBER HAS BEEN RECEIVED. NOW PLEASE TYPE YOUR PASSWORD. IT WILL BE INVISIBLE SO NO ONE ELSE CAN READ IT. PRESS SEND BLOCK WHEN YOU ARE DONE.

Inquirer: (Types in password)

System: BEFORE BEGINNING WITH THE REST OF THE SYSTEM, WE NEED TO KNOW CERTAIN BASIC FACTS ABOUT YOU. PLEASE TYPE YOUR FIRST AND LAST NAMES. PRESS SEND BLOCK WHEN YOU ARE FINISHED.

Inquirer: Robert Davis

System: THANKS ROBERT. NOW YOUR AGE IN YEARS. PLEASE USE NUMBERS, NOT WORDS.

Inquirer: 16

System: ARE YOU A MALE OR FEMALE?

Inquirer: Male

System: NOW TYPE YOUR GRADE IN SCHOOL. PLEASE USE NUMBERS, NOT WORDS. SOPHOMORE = 10, JUNIOR = 11, SENIOR = 12.

Inquirer: 11

System: WELCOME TO ISVD, ROBERT. WHEN YOU SEE THREE ASTERISKS *** AT THE BOTTOM OF THE SCREEN, THE MACHINE IS READY TO RECEIVE YOUR RESPONSE. IF YOU DON'T FEEL LIKE SAYING ANYTHING, SIMPLY PUSH THE "SEND BLOCK" BUTTON. TRY THAT NOW.

Inquirer: (Pushes Send Block Button)

System: SOMETIMES WE WILL ASK A DIRECT QUESTION, BECAUSE WE NEED TO KNOW SOMETHING FROM YOU BEFORE GOING ON. WHEN WE DO, PLEASE TYPE IN WHAT YOU WANT TO SAY AND PRESS SEND BLOCK. IS THIS CLEAR SO FAR?

Inquirer: Yes

System: YOU ARE ALMOST READY TO USE THE SYSTEM. THERE ARE JUST A FEW OTHER THINGS THAT YOU SHOULD KNOW ABOUT. IF YOU SHOULD WANT A PRINTED COPY OF WHAT IS ON THE SCREEN, WAIT UNTIL YOU SEE THE THREE ASTERISKS AND THEN PUSH THE BUTTON MARKED COPY PAGE. WAIT UNTIL THE MATERIAL HAS BEEN COPIED. THEN TYPE IN YOUR RESPONSE AND "SEND BLOCK". TRY IT NOW.

Inquirer: (Pushes Copy Page and Send Block buttons)

System: DID YOU GET A PRINT-OUT OF WHAT WAS ON THE SCREEN?

Inquirer: Yes

System: GOOD. SOMETIMES YOU WILL NOT KNOW HOW TO ANSWER THE SYSTEM WHEN IT ASKS YOU A QUESTION. IN THIS CASE, YOU SHOULD TRY TYPING @HELP. TRY IT ONCE.

Inquirer: HELP

System: NO, YOU DID NOT TYPE THAT CORRECTLY. TYPE THE SYMBOL @ AND THEN HELP. DO NOT PUT A SPACE IN BETWEEN.

Inquirer: @HELP

System: FINE. SOMETIMES THE SYSTEM WILL GIVE YOU A HINT WHEN YOU ASK FOR HELP, BUT NOT ALWAYS. YOU CAN ALWAYS TRY, THOUGH.

. . .

System: WHAT WOULD YOU LIKE TO DO?

Inquirer:

On subsequent visits to the system, a check is made to determine whether a record of basic information exists for him, and he is given an

increasingly brief review of the system operation and commands, with the opportunity for a more extensive review if he wishes.

At a slightly more complex level, many scripts, including reference and direct access scripts, have been modified to create summaries of each inquirer's interaction with the script, so that subsequent sessions with a given script include a review of the prior use of that script.

For example, in a script written to allow sorting of the occupational data file on the basis of an inquirer's preferences for different Dictionary of Occupational Titles (DOT) groupings, the inquirer first selects a broad occupational category (professional, technical and managerial, clerical and sales, etc.) corresponding to the first digit on the DOT code, and then a specific division within that category, corresponding to the second digit. On a subsequent interaction with this script, the system will recall this stored data from the inquirer's file and display the message:

> LAST TIME YOU WERE INTERESTED IN PROFESSIONAL, TECHNICAL AND MANAGERIAL JOBS HAVING TO DO WITH LAW AND JURISPRUDENCE. YOU CAME UP WITH THESE POSSIBLE JOBS: LAWYER, JUDGE

before going on to elicit his current preferences.

In other preference scripts, specific choices made within relevant factors are stored and retrieved upon further uses of the script. If a student has selected Geographic Location in two successive interactions with the college preference script, for example, the second request for his preferred area will include his prior choice:

> GEOGRAPHIC LOCATION IS GENERALLY CONSIDERED TO BE AN IMPORTANT CONSIDERATION IN COLLEGE CHOICE. LOOK AT THE SLIDE [a map of the United States divided into regions] AND TYPE IN THE AREAS OF THE COUNTRY YOU'RE INTERESTED IN:

YOU BEGIN WITH 376 SCHOOLS

A. NEW ENGLAND
B. MIDDLE ATLANTIC
C. MIDWESTERN
D. SOUTHERN
E. WESTERN
F. SOUTHWESTERN

LAST TIME YOU SAID E

A record is also kept, in binary form, of the jobs or schools which were retrieved in the preference script.

Further information is stored on the factors that the inquirer has chosen to use in sorting through the data file. If from one interaction to another an inquirer either adds a new factor to consider, or deletes a previous one, this fact can be made known to him. If so, he is asked whether he wishes to make a statement about any changes in his orientation toward this decision. He is then asked to compare his reason with two sets of possible reasons, one written into the script and another derived from other inquirers. If he feels that none of these reasons is close to his, i.e. that his reason is a unique one, he is given the opportunity of adding it to the inquirer-generated set:

Sample Monitoring of Factor Changes

System: ON THE FACTOR SEX OF STUDENT BODY (MEN, WOMEN, COED), YOU FELT IN THE PREFERENCE SCRIPT IT WAS IMPORTANT, BUT BEFORE IN YOUR LIST OF GENERAL CRITERIA YOU DID NOT MENTION IT. PLEASE EXPLAIN BRIEFLY WHY.

Inquirer: I got married.

System: SOME GENERAL REASONS FOR ADDING A FACTOR ARE:

1) I WANT A SMALLER LIST OF SCHOOLS.

2) SOMEONE SUGGESTED THAT IT MIGHT BE IMPORTANT.
3) I HAVE CHANGED MY MIND AND NOW THINK IT IS IMPORTANT.
4) I WANTED TO KNOW HOW THIS FACTOR WOULD CHANGE MY ALTERNATIVES.

Inquirer: (Makes a hard copy)

System: YOU SELECTED SEX OF STUDENT BODY MEN, WOMEN, COED IN THE PREFERENCE SCRIPT BUT NOT IN YOUR LIST OF GENERAL CRITERIA.

5) THE SCHOOL MEETS MY REQUIREMENT SO IT IS LESS IMPORTANT.

LOOK AT THIS AND YOUR GENERAL LIST. TYPE THE NUMBER OF THE REASON LIKE YOURS OR "NONE" IF YOURS IS DIFFERENT.

YOU SAID "I GOT MARRIED."

Inquirer: None

System: GREAT. MAY WE USE YOUR REASON TO SHOW OTHER INQUIRERS?

Inquirer: Yes

System: GOOD, NEW ANSWERS HELP US IMPROVE THE SYSTEM. WOULD YOU PLEASE TRY TO MAKE YOUR REASON SHORTER AND MORE GENERAL. IF YOU THINK IT IS OK NOW, JUST PRESS SEND BLOCK.

YOU SAID "I GOT MARRIED."

Inquirer: (Presses Send Block)

Data Access Records: The scripts which provide direct links with the ISVD data files have been modified to keep records for each inquirer of the possible choices (jobs, colleges, etc.) he has inquired about. When he has received a complete description of a choice, or when he has indicated an interest in a different choice from the one under consideration, he is asked whether or not he can classify this choice as a desirable or undesirable one for him. The choice is then placed on his "good" or "bad" list for that decision, and he is asked for a statement about why the choice looks good or bad to him. His statement is then subjected to a content analysis procedure (called ANALYZE) which maps it into a set of

general factors analogous to those used in preference scripts.

ANALYZE is a general-purpose "service routine" complementing several ISVD components. It creates a binary vector representing those factors recognized in the inquirer's statement, which can then be decoded and verified with the inquirer and stored for later comparison with vectors derived from other statements. An example of an interaction with an exploration procedure eliciting and verifying a statement about an inquirer's important factors for the discontinuity of college choice, together with an ANALYZE mapping and direct input to the college preference script is given below:

Example of College Exploration

System: WHAT DO YOU WANT TO DO?

Inquirer: Find a college

System: WHAT'S IMPORTANT TO YOU IN THINKING ABOUT COLLEGES?

Inquirer: I want to know how much it will cost, how far from my city the school is and if I can get in with my Board scores.

System: WE RECOGNIZED WORDS REFERRING TO URBAN OR RURAL SETTING, ADMISSION REQUIREMENTS, COSTS IN YOUR RESPONSE. IT'S ALMOST CERTAIN THAT THIS LIST DOESN'T INCLUDE ALL OF WHAT'S IMPORTANT TO YOU IN CHOOSING A COLLEGE. THE LIST MAY ALSO INCLUDE SOME MEANINGS THAT AREN'T IN YOUR STATEMENT AS YOU SEE IT.

Inquirer: Yes, it does.

System: IF YOU WANT TO KNOW HOW WE GOT ANY OF THESE MEANINGS OUT OF WHAT YOU SAID, TYPE IN THE MEANING YOU'D LIKE EXPLAINED, OR TYPE NO IF YOU DON'T WANT ANY MORE EXPLANATION. (URBAN OR RURAL SETTING, ADMISSION REQUIREMENTS, COSTS)

Inquirer: Admission Requirements.

System: IT SEEMED YOU WERE TALKING ABOUT ADMISSION REQUIREMENTS WHEN YOU SAID "GET IN." DID YOU MEAN ADMISSION REQUIREMENTS?

Inquirer: Of course

System: ARE THERE ANY OTHERS YOU WANT EXPLAINED? (URBAN OR RURAL SETTING, ADMISSION REQUIREMENTS, COSTS)

Inquirer: Urban or rural setting

System: IT SEEMED YOU WERE TALKING ABOUT URBAN OR RURAL SETTING WHEN YOU SAID "FAR FROM MY CITY." DID YOU MEAN URBAN OR RURAL SETTING?

Inquirer: No

System: WHAT DID YOU MEAN WHEN YOU SAID "FAR FROM MY CITY?"

Inquirer: I meant I didn't want to go too far away from home.

System: MAYBE WHEN YOU SAID "FAR AWAY FROM MY CITY" YOU'RE TALKING ABOUT GEOGRAPHIC LOCATION INSTEAD OF URBAN OR RURAL SETTING, SINCE YOU NOW SAY "FAR AWAY FROM HOME."

Inquirer: Correct

System: GEOGRAPHIC LOCATION IS NOW ON YOUR LIST INSTEAD OF URBAN OR RURAL SETTING. ARE THERE ANY OTHERS YOU WANT EXPLAINED? (GEOGRAPHIC LOCATION, ADMISSION REQUIREMENTS, COSTS)

Inquirer: No

In verifying the content analysis with the inquirer, he has the option of asking about any of the factors recognized, and restating the meaning of any he disagrees with. Note that the routine remembers the elements of the original statement which triggered the dictionary match (in the latter case "far...city" for urban or rural setting) and asks him for a clarifying statement. This new statement is again put through ANALYZE, and if the new match satisfies the inquirer, the old factor is replaced by the new one. If the second pass through ANALYZE still fails to provide a match the inquirer is willing to agree on, he is given the option of retaining or deleting the second factor. The statement elements

triggering dictionary matches are stored, providing a foundation for increased individualization of dictionary processing.

The following information is stored by this procedure:

a) The inquirer's original statement;
b) A binary vector representing the initial dictionary analysis;
c) A binary vector representing the final dictionary analysis;
d) The elements of original or clarifying statements which triggered dictionary matches;
e) A statement about additional factors not mentioned.

These data are indexed by session number and type of decision, e.g., college, job, etc.

The following is an example of the type of dictionary used in the ANALYZE procedure:

College Choice Dictionary

Ø = Any number of intervening words, or no words
$ = Check only this far.
(*)= Any of these words will do.

FACTOR:	EXPRESSIONS:
Geographic Location	North$, South$, East$, West$, Mid-west$, New England Where is In what part Ø (*U.S. US Country) (*Near far close away) Ø (*home family Folks Mother Father Parents Friends)
Type of College	Public, Private, Religio$, Catholic, Jewish, Protestant State (*School$ Colleges Universit$)
Sex of Student Body	Coed$, Co-ed$, Boys, Girls, Men$, Women$
Size of Student Body	How (*Large Small Big Little Many) Ø (*Student$ People Boys Girls Women Men It Is) (*Whether If How) Ø (*Large Small Big Little Many)

Types of Programs	(*Course$ Program$ Subject$ Major$) Ø (*Have Has Offer$ Avail$ Giv$) What Ø (*Stud$ Major$) Liberal Art$, Pre-$
Financial Aid	Scholarship$, Loan$ Financ$ (*Aid Help Assit$) Can't afford Help$ Ø Pay (*Part-time Team-time) Ø (*Work$ Job$) (*Work$ Job$) Ø (*During While At In) Ø (*School College University There)
Urban or Rural Setting	Rural, Urban (*Near Far In) Ø (*Town Citi$ City Country)
Special Courses	Seminar$, Tutorial$ (*Special Extra Differ$ Honor$) Ø (*Cours$ Program$ Stud$ Class$)
Extracurricular Activities	Band, Orchestra, Music, Club$, Fratern$, Soror$, Fun, Good Time$
Admission Requirements	Admit$, Admis$, Sat$, Boards, Scor$, Get$ Ø in, Let$ Ø in (*Grade$ Rank$ Stand$ Test$) Ø (*Need$ Neces$ Requi$ Should Have Ought)
Cost	Cost$, Fee, Fees, Books, Expense$, Tuition
Housing	Dorm$, Room$, Liv$, Apartment$, Resid$, Housing

The procedure which elicits and keeps records on whether an inquirer perceives a potential choice as good or bad for him can be combined with the exploration procedure presented in the Example of College Exploration via the ANALYZE routine to provide comparative monitoring of decision-making behavior over time. A set of higher-order monitoring procedures have been integrated with the system which assess what monitoring activities have taken place while keeping records on an inquirer's activities in the system.

For example, the procedure which creates a record of the possible alternatives an inquirer has classified as "good" (on his terms), also

checks on how many "good" possibilities he has indicated. When an inquirer has accumulated three or six[3] possible choices in his record, different sub-procedures are called into play. At the three-item point he is asked if there is one alternative which seems to stand out for him as the one he feels he actually will choose. If no clear preference is apparent at this time, he is asked if he can make a general statement about why these alternatives are desirable ones for him. This "meta-statement" about his set of possible future choices is also stored in his file, for future comparison with additional "meta-statements" and with specific statements about individual choices.

If, however, he does indicate that choice has occurred, he engages a clarifying procedure which attempts to relate his currently preferred alternative with past statements about general attitudes toward the decision. Related statements, as mapped by the ANALYZE procedure, are retrieved from his personal file and compared with current statements about the specific alternative. An example of dialogue with this set of monitoring procedures is the following:

Clarifying Monitor Procedures

System: YOU JUST GOT SOME DATA ABOUT BOSTON UNIVERSITY. DO YOU CONSIDER THAT COLLEGE
GOOD
BAD
NEITHER GOOD NOT BAD?

---

3. These numbers are essentially arbitrary, and determined primarily by considerations of storage capacity within the system. There are no apparent theoretical bases for specifying desirable limits or intervals for such a file.

Inquirer: Good

System: WHY DO YOU CONSIDER BOSTON UNIVERSITY TO BE A GOOD COLLEGE FOR YOU?

Inquirer: It's close to home and I think I can get in and I hear there are good fraternities there.

System: YOU'VE SAID THESE 3 COLLEGES LOOK GOOD TO YOU:
1. TUFTS UNIVERSITY
2. BOSTON COLLEGE
3. BOSTON UNIVERSITY
DOES ANY OF THESE COLLEGES STAND OUT AS THE ONE YOU'LL GO TO?

Inquirer: Yes

System: WHICH ONE? (TYPE THE NUMBER.)

Inquirer: 1

System: YOU SAID TUFTS UNIVERSITY LOOKS GOOD BECAUSE "IT'S NOT FAR FROM HOME AND IT'S NOT TOO EXPENSIVE." IS THERE ANYTHING YOU'D LIKE TO ADD TO YOUR REASONS FOR LIKING TUFTS UNIVERSITY?

Inquirer: It has good fraternities.

System: WHEN YOU WERE TALKING ABOUT COLLEGES IN GENERAL,[4] YOU SAID GEOGRAPHIC LOCATION, ADMISSION REQUIREMENTS, COSTS WERE IMPORTANT. IN DESCRIBING WHY YOU LIKE TUFTS UNIVERSITY, YOU SEEM TO BE TALKING ABOUT GEOGRAPHIC LOCATION, COST, SOCIAL ACTIVITIES. WHAT ABOUT ADMISSION REQUIREMENTS, SOCIAL ACTIVITIES?

Inquirer: They're okay.

System: HAVE YOU LOOKED INTO THE ADMISSION REQUIREMENTS, SOCIAL ACTIVITIES OF TUFTS UNIVERSITY?

Inquirer: Yes

System: HOW DOES THAT MAKE YOU FEEL ABOUT TUFTS UNIVERSITY? IS IT STILL THE COLLEGE FOR YOU?

Inquirer: Yes

System: YOU SEEM FAIRLY CERTAIN THAT TUFTS UNIVERSITY IS THE COLLEGE FOR YOU. WHAT DO YOU PLAN ON DOING ABOUT GETTING TO TUFTS UNIVERSITY?

Inquirer: See my counselor, get an application form.

---

4. This example is keyed to the earlier Example of College Exploration. The "colleges in general" factors are taken from that interaction.

Had the individual not maintained commitment to his chosen alternative, he could select another of his three colleges to clarify, find out more information about any of them, or continue to explore the data file for additonal potential choices.

In addition to Review functions which have been integrated with other system components, e.g. Preference scripts, there is a separate Review procedure which feeds back to the inquirer a summary of interactions. It is accessed in two ways. First, after an inquirer has had several interactions with the system, the Major Orientation script checks his personal file for recent significant events, such as alternatives selected by Preference scripts or requested in Data or Template scripts, other scripts taken, and the major topics of interactions. It then displays for him a capsule description of his activities in the most recent session.

Second, at any time during the course of an interaction, an inquirer may request a similar description of his current activities using the @SUMMARY command. In this case, after he has received a system summary of the interaction, he is linked to a separate script which elicits his own perceptions of the session, and his comparison of it with his expectations. In this script, prior statements of anticipation and expectation for sessions are retrieved as well.

The general form for the system review of a current or prior session is as follows:

Sample Review Interaction

Inquirer: @SUMMARY

System: TODAY YOU'VE BEEN WORKING ON A DECISION ABOUT COLLEGES. YOU LOOKED AT SCRIPTS ABOUT FACTORS IN COLLEGE ADMISSIONS, COLLEGE PREFERENCES, COLLEGE DESCRIPTIONS, DATA.

Inquirer: (Pushes Send Block)

System: IN THE COLLEGE PREFERENCE SCRIPT, THE CHOICES YOU MADE SUGGESTED 6 COLLEGES:

UNIVERSITY OF MASSACHUSETTS
BOSTON UNIVERSITY
BOSTON COLLEGE
UNIVERSITY OF ARIZONA
UNIVERSITY OF MARYLAND
UNIVERSITY OF CALIFORNIA AT BERKELEY

Inquirer: (Pushes Send Block)

System: YOU ASKED TO HAVE THESE COLLEGES DESCRIBED:

UNIVERSITY OF MASSACHUSETTS
UNIVERSITY OF MARYLAND
UNIVERSITY OF CALIFORNIA AT BERKELEY

YOU ASKED SPECIFIC QUESTIONS ABOUT:

BOSTON COLLEGE

Inquirer: (Pushes Send Block)

System: YOU'VE NOW BEEN WITH THE ISVD FOR A LITTLE WHILE. HOW WOULD YOU NOW DESCRIBE YOUR EXPERIENCE HERE?

Inquirer: Pretty interesting

System: THE SUMMARY STATEMENT YOU JUST MADE ABOUT THE WAY YOU FEEL ABOUT YOUR TIME WITH ISVD IS BEING SAVED FOR YOU.
WHAT DID YOU EXPECT YOUR TIME WITH ISVD TO BE LIKE?

Inquirer: I didn't really know.

System: THERE ARE TWO NEW COMMANDS (LIKE @DATA, @STOP, ETC.) FOR USE IN THIS SCRIPT ONLY. THESE ARE:

*THEN

AND

*NOW

NOTE THAT THE SPECIAL SYMBOL BEFORE THESE NEW COMMANDS IS
* NOT @
TYPE *THEN WHENEVER YOU WANT TO LOOK AT YOUR STATEMENT ABOUT WHAT YOU EXPECTED YOUR TIME WITH ISVD TO BE LIKE.
TYPE *NOW WHENEVER YOU WANT TO LOOK AT THE STATEMENT YOU JUST MADE ABOUT THE WAY YOU NOW FEEL ABOUT YOUR TIME WITH ISVD.
HOW DOES YOUR EXPERIENCE WITH ISVD COMPARE WITH WHAT YOU EXPECTED?

Inquirer: Strange

System: SORRY, WE COULDN'T UNDERSTAND. PLEASE TRY AGAIN.

Inquirer: Pretty different

System: THEN YOU FEEL THAT THERE HAVE BEEN SOME CHANGES IN YOUR FEELINGS DURING THIS EXPERIENCE.
WHAT ARE SOME OF THE DIFFERENCES BETWEEN WHAT YOU EXPECTED AND WHAT HAPPENED?

Inquirer: I don't know.

System: WHAT WERE THE REASONS FOR THE DIFFERENCES BETWEEN WHAT YOU EXPECTED AND WHAT HAPPENED?

Inquirer: I don't know.

System: ARE THESE DIFFERENCES BETWEEN WHAT YOU EXPECTED AND WHAT HAPPENED IMPORTANT TO YOU?

Inquirer: Yes

System: WHY ARE THESE DIFFERENCES IMPORTANT TO YOU?

Inquirer: Because I didn't know what to expect and now I do.

System: WE'VE ASKED MANY QUESTIONS IN THE LAST FEW MINUTES, AND MAYBE YOU'VE ASKED YOURSELF SOME, TOO. YOUR OWN QUESTIONS CAN BE MUCH MORE IMPORTANT THAN ANY WE COULD ASK.
IF YOU HAVE ASKED YOURSELF SOME QUESTIONS AS WE'VE GONE ALONG, OR IF SOME COME TO MIND NOW, YOU CAN SAVE THEM IN YOUR PRIVATE FILE BY TYPING THEM IN.
IF THIS ISN'T SOMETHING YOU'D LIKE TO DO NOW, PUSH SEND BLOCK AND WE'LL MOVE ON.

Inquirer: (Pushes Send Block)

System: NOW LET'S REVIEW WHAT WE'VE BEEN DOING. YOUR STATEMENT ABOUT WHAT YOU EXPECTED YOUR SESSION WITH ISVD TO BE LIKE WAS, "I DIDN'T REALLY KNOW." AFTER YOU HAD BEEN EXPERIENCING ISVD FOR A WHILE, YOU MADE THIS STATEMENT ABOUT WHAT IT WAS LIKE:

"PRETTY INTERESTING." THE COMMANDS *THEN AND *NOW ARE STILL AVAILABLE IN CASE YOU WANT TO LOOK AT THESE STATEMENTS AGAIN. YOU COULD ALSO MAKE A HARD COPY OF THEM TO KEEP.

Inquirer: *THEN

System: YOU SAID, "I DIDN'T REALLY KNOW."
AFTER YOU MADE YOUR SECOND STATEMENT, WE ASKED SEVERAL QUESTIONS. FIRST, WE ASKED IF THERE WERE DIFFERENCES BETWEEN WHAT YOU EXPECTED ABOUT ISVD AND WHAT YOU FOUND IT TO BE LIKE. YOU SAID, "I DON'T KNOW."
THEN WE ASKED WHY THERE DIDN'T SEEM TO BE DIFFERENCES, AND YOU SEEMED UNSURE.

Inquirer: (Pushes Send Block)

System: IN GOING THROUGH THIS REVIEW EXERCISE, YOU CHOSE TO LOOK AT YOUR STATEMENT ABOUT WHAT YOU EXPECTED ONCE. YOU CHOSE NOT TO LOOK AT YOUR STATEMENT ABOUT HOW YOU FELT AFTER USING ISVD FOR A WHILE.
FINALLY, WE ASKED IF YOU HAD ANY QUESTIONS ABOUT YOUR EXPERIENCES THAT YOU WANTED TO SAVE, AND YOU CHOSE NOT TO SAVE ANY OF YOUR QUESTIONS.

The monitoring procedures described above, although they bear the names "Explore", "Clarify", and "Review", are not easily attributable to a discrete paradigm stage or system function. The Explore routine, by its focus on dialogue about linguistic expressions of decision-making criteria, has a clarifying aspect, in that it makes more explicit, or at least points up tacitness of, bases for decisions. In addition, it performs these functions by engaging the inquirer in an immediate review of statements he had made about his decision-making.

The clarification procedure also has aspects of Exploration and Review to it, particularly the latter. Statements about specific alternatives are elicited while the inquirer is in the process of sorting through data files without necessarily feeling commitment to one possibility over another, i.e. while he is exploring. The procedure takes its

name from the fact that these earlier stages statements are Reviewed when the inquirer has indicated at least tentative commitment to an alternative, i.e. when choice has occurred, and clarification of the alternative can logically be expected to begin.

The three access routines, Exploration, Clarification, and Review, which were originally conceived to overlay the system as separate but unifying linking and monitoring routines, are presently reflected in a number of different system routines which have been developed and modified to perform access functions. What we originally called Access Routines are now not discrete procedures, but a diverse and inter-penetrating set of minute functions which physically reside in a number of locations. It is this systematic diversity which has enabled us to specify operationally what functions should be performed in an interactive Guidance system, and which provides the direction for future development of monitoring procedures.

An early ISVD document described monitoring in the system as a heuristic feedback device which would lead inquirers to develop in themselves a condition of doing-while-observing:

> "Aside from the usual reasons for monitoring a student's behavior--to analyze his performance, select from alternative courses of action, and generally maintain an account of his interaction with a system--the project expects to present to him the facts of this monitoring so that he might use them as additional data. These facts become a kind of meta-data which the student processes. Not only does the individual act but he becomes aware of his pattern of action. The desired result is a higher order of understanding of both the decision-making act and the panorama of career choice in which decision points are linked. Career becomes a time-extended set of choices, and decision at any given point is enhanced by an overall awareness of the road being travelled."
>
> (Ellis and Wetherell, 1966, p. 2)

It should be apparent that much remains to be done in reaching the level of feedback suggested in the above passage. Having created discrete system components to perform separate functions, modified them as monitorable behaviors became apparent, and created new procedures where monitoring was lacking, we are now in a position to continue system development with these steps more synchronized.

Part II:

Access Functions Beyond Phase I

A. Decision-Making Paradigm

The career development decision-making paradigm of Tiedeman and O'Hara, which has been the theoretical foundation for the ISVD, has had considerable heuristic value for the development of the system. However, in a fully operational Guidance system modeled after ISVD, this paradigm needs extension in several important areas.

First, its concepts of basic processes and of identifiable stages need to be further defined and examined against the background of actual decision-making experience of individuals. Some beginnings have been made in this direction in the field testing of ISVD, but the complexity of the model and of the phenomena it attends to demands more basic research in the ways people approach different decisions at different points in time, and in the extent to which people do and can generalize their decision-making experiences within and across particular discontinuities.

Second, given the emphasis in this paradigm on language as the medium of comprehension of career development (see Tiedeman, 1969, "Individual Comprehension of Epigenesis in Career Development"), operational definitions need to be expanded with more accurate and extensive samples of normative and idiosyncratic linguistic patterns accompanying discontinuities, decision-making stages, and personal characteristics. The field test experience has led to impressions of how well ISVD's language processing routines match the verbal capacities and styles of individuals

at different age and ability levels, as they struggle to make sense out of their experience in decision-making and career development through language. However, there is much remaining work in uncovering the subtle relationships between language and the complex cognitive and affective components of decision-making experience. Several proposals are in different stages of preparation to refine the career development paradigm along these lines.

Such research, however, should not proceed independent of further efforts toward operational representation of the paradigm through system development and revision. Because of an overriding emphasis in the present project on providing data files and means of access consistent with different discontinuities and decision-making stages, little has been done to explore differences in the ways people approach the same discontinuity at different life stages. Consideration of college choice, for example, is a different experience for a junior high school student and a senior high school student. Such differences are probably manifested in the style of approach to the discontinuity, and deserve different emphases, particularly in the other decision-making areas which touch upon the one in focus. The primary tangent to college choice for a senior high school student is most likely job selection and planning, while for his junior high counterpart (or even himself as a junior high school student), the most important related topic may be choice of high school program and courses. Consideration of this time-extended sequence of approaches to the same discontinuity, as related to presently experienced discontinuities, is an important future direction in the development and implementation of career development theory through interactive systems for decision-making.

An interactive environment like ISVD provides a laboratory in which theory can be elaborated and refined in two important ways. Since functional system components require precise specification of goals and procedures, the act of designing and modifying a system has direct implications for the underlying theory as well. In ISVD thus far, we have found script-writing to be a challenging, often frustrating experience as well as a source of feedback and insight into the theory as we have attempted to implement it.

An operating system is also a data-collecting mechanism, in which the processes of decision-making development are open to direct examination. Such observations provide the external feedback necessary for continued assessment and revision of the theory. Having begun these efforts through ISVD, we urge their continuation. The practice of guidance requires this interplay among theory, operational specification, implementation, and research if it is to grow as a profession and grow with its clients.

B. System Access

The field test, though abbreviated, did provide a number of observations about how individuals interact with this guidance environment, and how further prototypes of ISVD might be modified to make it more responsive to and consistent with the decision-making behavior of its clients. This section describes some of the reactions of inquirers to different components of the system, along with suggested modifications.

Introductory Scripts: Most inquirers found the introductory scripts to be satisfactory, though initially confusing. The quality of these scripts was also reflected in the ease with which almost all inquirers

learned the mechanics of the system. Most of the difficulty with these scripts involved relatively easily remedied elements. For example, the "@" symbol which prefixes the commands is somewhat difficult to find on the keyboard (upper case of the letter "P"), and every student required assistance in locating it. In addition, once found, many commented that it did not resemble the symbol as displayed on the screen.

Inquirers also seemed unsure at first about when a response was called for. Several were very ready at once to carry on a conversation with the system, responding "Okay" or "I understand" when the system was explaining something. Others appeared to hang back from answering, as if they wanted to be very sure what was being asked for before committing themselves to any statement.

This uncertainty was intensified by ambiguity in the introductory scripts (and elsewhere). For example, the instruction in the use of the hard copy device contains the phrase "Wait until the material has been copied, then type in your response." Many inquirers thought that this was a direction to them to respond substantively in some way, and didn't know what response they were supposed to make. The appropriate response in this introductory frame was a simple "send block" to indicate readiness to proceed.

The most serious difficulties of this type occurred in the script explaining the use of the command language (@DATA-, @STOP, etc.). Most students seemed to feel that this introduction was a request to type in a command, rather than just a description. These unaticipated effects of the introductory scripts, along with the fact that they are a person's first contact with the system, seem to have created an undesirable set,

at least in some inquirers. The unresponsiveness of the Introduction to System script, which explains the console mechanics, seemed to extinguish the openness and tendency toward free response which many inquirers brought to the system. In the Introduction to Commands, which immediately follows, the unusual combination of structure (in specifying exact configuration of requests) and ambiguity (in not sufficiently specifying the circumstances in which such requests should be used) appeared to focus attention toward premature reliance on the commands as the desirable and perhaps sole acceptable means of communication with the system. These scripts should be made more explicit about the different communication modes in the system, and in particular, emphasize their own explanatory function.

Orientation Scripts: Confusion about phrasing responses was to some extent reinforced by the orientation, or routing scripts. The open question, "What would you like to do?", as expected, had a strong impact on inquirers in the field test. Most experienced initial difficulty in comprehending and responding to it, but were able to phrase intelligent replies within one or two sessions. However, most inquirers felt that the system's language recognition routines were not comprehensive enough to handle their questions. In particular, the remedial frames which attempt to get the inquirer to rephrase responses did not seem to help. Inquirers seemed caught between the seemingly conflicting instructions to be more specific and to use general words.

This situation was complicated by the system's occasional inability to use the lists it did have appropriately. Responses which logically should have matched stored dictionary strings sometimes did not, which was very frustrating for inquirer and supervisor alike. The natural

language aspect of the system's design cannot be said to have been adequately assessed, because of these processing problems and because of the short time of the field test.

One remedy, along with increasing dictionary lists for orientation scripts, would be to have more specific "back-up" procedures for unsuccessful or partial recognitions of student input. Two responses which seemed to occur frequently among high school students in response to "What would you like to do?" were "go to college" and "be a (job name)." Many inquirers also typed in just job names, e.g. "architect" or general alternatives, e.g. "two year colleges." Few indicated their confusion or uncertainty directly by typing in "I don't know.", "What can I do?" or using the @HELP command.

These different types of unrecognized inputs suggest that, at least under the circumstances of the present field test, students are not likely to indicate an orientation to a decision, but only the area of the decision if one is perceived. Responses like "I'd like to choose a college." which was an anticipated link to the preference script, did not occur. It seems that direct inquiry by the system in cases of partial recognition, e.g. if only the word "college" is picked up, would be more helpful than requests to rephrase the response. For example, if the word "college" is recognized, the system could ask whether the inquirer had a specific school in mind (suggesting a data access script), or was more interested in finding some possibilities for exploration (via the preference script). A similar procedure does exist in the occupational orientation script, and seemed to be successful, except that inquirers frequently did not get to it until after several frustrating requests to "please rephrase."

When difficulty with the language routines was not too frustrating, or when other aspects of the experience were seen as positive, inquirers seemed to perceive positive qualities to the communication mode, although most would probably have preferred a more structured format. One student, who had a particularly difficult time in communication with the system, commented that it was still very helpful, because having to rephrase questions forced him to look at different sides of the decision, and to consider facts he might otherwise have overlooked.

Another student, who seemed to feel that communication channels were too structured, suggested that the system be entirely natural-language based, to allow more personal relating of individual characteristics to educational and occupational alternatives. Most students appeared to feel that, while being able to interact with the system in their own words was a good idea, the system should have been better at understanding them. A common reaction of students was to rely more on the supervisor or on the @DATA commands than their constructed responses when initial attempts at natural communication were unsuccessful. Observations and discussions with students suggest that there is an optimum limit to communication difficulty which must be maintained if the experience of interaction is to facilitate learning about one's own use of language.

Direct Access Scripts: At certain junctures in the system, and at any time using the @DATA command, the inquirer is placed in direct contact with the ISVD data files. The DATA script responds to direct requests for information about specific alternatives by guiding the inquirer through a structured dialogue. He is asked first for the name or ISVD identification code number of the school or job of interest, and then is

asked to type in the variable (information category) he wants to know (tuition, working conditions, etc.).

A major difficulty in using the DATA scripts is that record names (jobs, schools, etc.) need to be typed in the exact form in which the information is referenced. For example, a student will have no luck trying to find out information about U. Mass. or M.I.T. The system was originally programmed to recognize names like "University of Massachusetts" and only those words as referring to that institution. Alternatively, the inquirer could type in the number "094" which is the ISVD identification number for this school.

Several attempts were made to overcome this difficulty: first, by suggesting that inquirers make hard copies of lists derived from preference scripts; second, by adding automatically the words college and university to unrecognized college names (allowing requests like "Harvard" to be processed successfully); and third, by providing "helping" scripts which would assist inquirers in using correct names and variables. These last scripts, however, appeared to confuse inquirers more than help them, particularly the Helpname script. The chief difficulty with this script was its confusing instruction, "Select, create, or combine lists, or see a list you already have." Inquirers were not able to understand what was involved in these options, and most chose the last alternative, thinking it meant a list already made up by the system. Instead, it referred to a list which the student had previously stored, for example from a preference script. Since most saw this script before using a preference script, the most frequent system response was "Since you have not taken the preference script, no list is available."

Difficulties in typing in correct names were of three types: incorrect or incomplete name; incorrect spelling of name; or alternative not included in data file. Since the system has no way of differentiating these, remedial materials were difficult to develop. Mid-way through the field test, hard copies of names contained in the data files were placed at the consoles, and supervisors and students got into lively dialogues about what name the system might have a particular job or school filed under. This approach seemed to work quite well, and might be incorporated in a future version of the system, particularly where storage capacities would allow multiple naming of data records. Such a strategy, perhaps combined with a lexical transformation routine, would make querying of data files much easier.

The Helpvar scripts, which come into play when an inquirer has typed in a recognized name, but is having difficulty phrasing a request for information, seemed more helpful. These also suffered from confusing complexity, however, as in their offering the choice of "detailed" or "simple" variables. Fortunately, most students wisely chose the simple route. One unexpected tendency in inquirers was to type in a response as soon as possible, analogous to their premature use of commands in the introductory scripts or orientations. The Helpvar scripts operate by presenting examples of variables as he wishes, making hard copies if he desires, and then return to the major data access script by using the @STOP command. Instead, many seemed ready to settle for the first "legal" request that came along, occasionally regardless of what their original request had been for. As a remedy for this unwanted shaping of behavior, the system might go directly to a list of factors without providing

examples, and be programmed to respond to a typed-in variable directly without requiring manual transfer back to the Data script.

Another frustrating aspect of the Data routine involved the incompleteness of information contained in the files, and the mechanistic way in which the system handled absent information. One of the most frequent requests for data at the high school level focused on admission requirements for various schools. Specific information on College Board scores or selectivity of schools was lacking, and the most common response was "Achievement tests are required." If a student replied, as some did, "What are they?" the system took no notice.

When a data category was blank, the system would occasionally reply "No information is available about (that category)," but more frequently seemed to display a template sentence without any substance. At times this tendency resulted in apparently erroneous information. A request for location of an urban school might result in the message "It is miles from the nearest city," which, for a rural institution would be filled in, e.g. "It is 72 miles from the nearest city, San Francisco." These annoying inconsistencies should be eliminated.

Inquirers in general had more success with Template scripts than the Data scripts. Templates operate primarily in a multiple-choice mode, offering a selection of topics about a job or school. The Job Template, for example, begins with a brief description of the type of work involved, and offers the choice of information about requirements for entrance and advancement, wages and benefits, personal aptitudes required, and working conditions. The major difficulty with these scripts was that they were difficult to access. The @DATA command links directly to the Data script,

which requires phrasing of a specific request. As originally programmed the Templates could be accessed by using the word "describe" or "description" along with a data file indicator (job, college, school, etc.) in response to the question "What would you like to do?" or by requesting further information about alternatives named at the conclusion of the preference script. During the field test, as supervisors noted that inquirers either did not know what to ask in the Data scripts, or had trouble phrasing requests, an option was included in the Data script whereby the response "everything" when asked for a variable would automatically link to the appropriate Template. In general, the Templates, along with the Preference scripts, provided the best semblance of dialogue in the system.

Preference Scripts: These were by far the most well-received scripts. Students found it very exciting to go through a set of individualized criteria, leading to a list of colleges or jobs for further exploration. Some made comments like "I thought they (the questions in the Preference script) were a good way of classifying, rather than get a job and be stuck with it."/ "Could you explain a little more."/ "It seemed to me that those classifications were up to you, what you wanted to do, what you liked to work with, and things like that, rather than just getting a job, which I've been doing personally, and not being satisfied."; "It's helpful knowing what colleges there are, and what specific things are involved, location, that sort of thing."; and "The way the computer goes about it, making me choose, is really good. The more you choose, the more it cuts down on the colleges for you, and that's good."

Students caught on very quickly to the effect of their choices on the number of alternatives remaining in contention for them. Almost

everyone commented on the speed with which their list shrank, especially in the Job Preference script, and modified their behavior accordingly. This external pressure to be selective about criteria often pointed up latent value patterns for students. One commented at the conclusion of the College Preference script, "Now I want to change what I said a little bit. Sometimes there I could have said one thing or another, it was pretty close. I'd like to see what happens when I change." In the next round, when his choice of school size reduced his list from 129 to 11, he skipped other factors and said, "I'm not going to push 'radio station' (which he had indicated previously as a desired extra-curricular activity). I'd like it, but I don't care that much. I'm not going to base my college on it."

Another student went through the College Preference script several times in her final session and in her interview commented that she had gone through the script differently for the "two different people" she felt herself to be. She explained that she felt two different sets of criteria operating in her college choice, and wanted to see the implications of these two patterns and the possibilities they opened up for her.

The Preference scripts sometimes caused negative reactions in students which, however, indicate some of the potentially deeper effects of such "valuing procedures" on self-understanding. A student who made positive comments about the College Preference script, became very angry while taking the Job Preference script. These two scripts differ in that the College script concentrates on characteristics of schools, while the Job script also includes several questions about self,

e.g. "I am high/low/average in general intelligence." He resented "having to put myself in those little boxes." and felt that the script was not "personal" enough. It might be, however, that these questions were too personal and consequently made him feel anxious. He commented at one point that the machine was trying to tell him whether he was dumb or smart. After this script, the supervisor suggested the D.O.T. sorting script, which has a more external emphasis on job classifications. He did so, but seemed still to be reacting to his experience with the Job Preference script. He indicated that he wanted to look at "Miscellaneous" jobs, and then rejected the categories included in this major division. The effects of his having done this more impersonal script first might have been different, and a comparison of how these two approaches made him feel might have provided a source of insight for him. As it was, however, there seemed to be an overriding "halo effect" which prevented him from differentiating the two experiences.

The experience of another student also seemed to center on the Preference script. The turning point in her feelings toward the system seemed to occur in the College Preference script during her third session. In her first two times, she had concentrated on this script, indicating admission requirements as her only criterion. She received many schools, and excitedly copied each segment of the list as it was displayed. She did the same thing in the third session, mentioning only admission requirements, and was upset that University of Massachusetts did not appear on her list. She then tried to find out the admission requirements of this school, using the @DATA command, but was unsuccessful. In the discussion following the session, she said that she was a stubborn person,

and " just won't accept anything from another person or another thing." Her reaction to the apparent inconsistency between her plans and the schools suggested by the system seemed to take the form of a rejection of the system rather than a consideration of possible reasons for the lack of fit.

This turning away was probably intensified by her difficulty in querying the system directly for information about her preferred choice. She complained, "It's a hassle getting the computer to understand me. It got so I just couldn't rephrase what I wanted any more." She was also concerned during the session because the admission requirements section of the Preference script asked about her class rank, which she didn't know.

Further discussion about her decision-making turned up the fact that, while she had earlier rejected University of Massachusetts as a desirable school (complaining that her parents were pushing it too much and "everybody goes there") she had just recently been thinking more about going there. It appeared that, in the face of her ambivalent feelings, she was attempting to use the system to confirm her recent and precarious choice. She also was quite resourceful in this attempt, trying first the Preference script, and then the Data routine. A revised system might pick up the fact that she was asking specific questions about a school which was not on her Preference script list, and query her about the origin and status of the choice. It would also understand and respond to her request for admissions information about the University of Massachusetts.

In this case, the fact that the system could not stay with her shifts in decision-making, combined with the distractions and pressures of the end of the school year and her excitement over a recently acquired driver's license, caused her to lose interest in further work with the system. She came just once more and seemed distracted and erratic in her interaction with the system. She explained that she "wasn't as psyched" as before about using the system, laying the blame on herself and her "laziness." While the elements in the situation might have dictated a "moratorium" on vocational planning, her interactions with the system could have generated some insight into the shifts in her decision-making.

Several students felt that Preference scripts should be expanded to encompass more information. They felt this most strongly in the College script, where their primary concern was most often admission requirements. The script in its present version includes only high school class rank as an admissions factor, which most students in the field test did not know, and which was less salient in their decision-making than grades and Scholastic Aptitude Test scores. Such variables ought to be included in the College Preference script, particularly since most students seemed to approach college choice almost exclusively from the standpoint of acceptance requirements.

Links between the different Preference scripts and data files should be expanded. Students frequently wanted explicit information about the relationship between occupational and educational decisions, e.g. "What are good schools for Architecture?" and found it difficult to get the system to react to such shifts. A further difficulty within the educational data file was the seemingly artificial distinction between colleges

and trade schools. Often, students had post-high school plans which did not fall clearly into one area or another, e.g. a secretarial program (which is a trade school variable) at a junior college (which is part of the college data file). The feasibility of merging these two files with a wider set of sorting criteria should be explored.

Students also felt that the system should have a set of internal criteria about the individual which could be used to check their responses and point out inconsistencies, errors, or deceptions which might invalidate their use of a preference script. The students seemed to feel that college or job choice was too important a decision to leave to self-perception alone. This need for external confirmation of their own estimates was brought out very strongly toward the end of the field test period when Scholastic Aptitude Test scores were distributed. Many had certain expectations about college choice from Preliminary test scores, and their planning was considerably affected by receipt of this additional information. Unfortunately, there was no way to use this directly in interactions, and the system therefore did not facilitate integration of this information in their decision-making.

A further revision, outside the structure of the Preference scripts themselves, should be made in assisting inquirers to access the scripts. Although most students in the field test seemed to be in a stage of decision-making development where an exploratory procedure like a preference script would be helpful, intervention by the supervisor was almost always necessary to link the student to the script. The tendency mentioned above toward not specifying an orientation toward the decision seemed particularly strong in the earlier phases of a decision, i.e. when a

preference script is probably most appropriate. These scripts should be made more accessible to inquirers, by providing more sophisticated branching logic in orientation scripts.

Teaching Scripts: These scripts were almost never used, the major reasons being that most students were most interested in the data retrieval and preference scripts, and those who were interested in general information did not phrase requests in a way that had been anticipated in language recognition rules. Requests like "Tell me about college costs." or "How do I get a job?" just didn't occur. In the few instances where these scripts were used, reaction seemed to be favorable. One student, who was probably the least skilled and experienced in decision-making, eventually got into scripts about location and size of colleges, and felt that this type of general information was most appropriate for him. Another student, found that the military overview script, which discusses some of the mechanics of selective service and enlistment, provided some information that was both new and important to him. A third student did not like the Military overview because it concentrated too much on salary, which for him was the last thing to consider about military service. He would have preferred it to have dealt more with the experience of being in the armed forces, such a camp life, food, etc.

As in the orientation scripts, a primary revision would be in routing and linking these scripts. Students who are most in need of grounding in general decision-making concepts seem least likely to be able to phrase this need explicitly. One strategy would be to link these teaching scripts with preference and data scripts, where lack of knowledge or difficulty in applying these concepts might be apparent to more sophisticated monitoring procedures, and lead to accessing of teaching scripts.

C. Monitoring of Decision-Making Behavior

The most frequent occurrence of monitoring in the system during the field test was the record-keeping associated with Preference scripts; e.g. "Last time you said E." Most students noticed the reminders of previous activity and made comments like "Oh! It remembers me!" One student commented that this feedback was not a good idea, because it would lead a person to repeat his previous choices just because they were there. While this tendency would probably vary with individuals, the fact that he did see it that way is in itself an important indication of how he sees his own decision-making and the role of the system.

This student's experience points up an important consideration for monitoring procedures. Potentially, one of the most significant indications of a person's orientation toward his decision-making is his way of approaching the system. His anxiety, freedom , sense of "adventure", or whatever constellation of emotion and thought he brings to this encounter has implications not only for the way the system should respond with him, but for the way in which he carries out the internal dialogue which leads to comprehension of decision-making development. Unfortunately, much of this information is generated outside the sensory equipment of the system, in questions or comments directed to supervisors, posture, tone of voice, and facial expression. Other behaviors, which are directed to the system, but which are difficult to recognize, include one student's typing in all the factors the first time he used the College Preference script, with the smiling comment "This will get it!" Without the smile or the comment, a number of inferences might have been made from this behavior sample, probably none of them correct. In a similar fashion,

another student's responding "Be a bartender" in her last session, with the aside "I want to type in something just for fun." might have been picked up as a sudden shift from an educational focus to an occupational one, but the central quality and whatever implications (anxiety, autonomy in the face of pressure toward "realistic" goals, relaxation, curiosity, etc.) it has for her, would be very difficult to monitor. This shift, for example, is different qualitatively from that of another student, who changed suddenly from the College Preference script to the Data script for jobs because the question about programs of study in the Preference script made her realize that she needed to know more about her current job choice before selecting a college. The reasons for this shift were also not conveyed to the system in any recognizable way.

A possible solution to this problem of lost information would be to interject questions at unusual occurrences in interactions. It would be relatively easy to note a sudden shift from one data file to another, and to inquire about reasons (analogous to the script which monitors changes in the College Preference script). One drawback to this approach is that, at least with the present system and the need to make interactions conform to school schedules, there is little enough time to perform primary functions, such as data retrieval and Preference scripts. Inclusion of additional monitoring probes might be seen as unwelcome intrusions in an interaction, especially if a student was making a critical request for information very near the end of a session.

An alternative, which has been suggested in earlier treatments of ISVD Access Routines, would be to offer inquirers the option of having the system operate in a monitoring mode (which such shifts would be noted

and questions interjected) or not. A difficulty with this is that most inquirers, particularly in the early stages of their contact with the system, are probably not in a position to make that judgment, and the confusion likely to be involved in explaining the choice to a naive user would probably be more time consuming than any monitoring procedure itself.

The best strategy would seem to be the provision of monitoring routines which would intervene at certain points in interactions, but which could be ignored by the inquirer if he wished. It would also be necessary to have the function of these monitoring frames made explicit to inquirers, so that confusion and ambiguity about them would be minimized.

Most of this additional monitoring would include "summary statements" which would be offered by the inquirer and/or elicited by the system at certain points e.g. when a decision was being introduced by the inquirer, when choice seemed to be occurring, when implementation was being initiated, and when the effects of the decision were being experienced. Such statements, cross-referenced by the system records of interactions and by the inquirer's decision-status, have been described in earlier reports as a basis for periodic review of decision-making development by the inquirer.

The Exploration, Clarification, and Analyze routines described above are the beginnings of this form of individualized monitoring. Their strongest potential lies in the provision of natural language dictionary lists which can reduce inquirers' statements to a list of common factors which, as shown in the Clarification example, can be manipulated and compared across time. Several extensions seem desirable in advancing the state of these procedures.

First, the system-based dictionary lists should be made more extensive and validated against the experience and perceptions of inquirers. As explained above, the brevity of the field test and difficulty in programming these routines precluded their evaluation as part of Prototype II, although considerable experience was gained in the mechanics of designing and implementing such procedures.

Second, the factors which constitute dictionary categories in the Analyze procedure are reflected elsewhere in the system, as sorting categories in Preference scripts, and as variables in Data and Template scripts. This consistency across different system components should be exploited more via Review procedures for comparisons of value patterns at different times. A beginning has been made in this direction through the Clarification and Factor Change scripts, and can be expanded to include monitoring from direct data access and teaching scripts as well.

Third, it would be possible to include in an Analyze procedure provisions for idiosyncratic dictionary construction which would allow inquirers to increase correspondence between system routines and their own experience, as well as provide an externalized record of their meaning systems at different times and with respect to different discontinuities. Such individualized dictionaries would become part of an inquirer's personal file and could be used to process later statements. These would be especially powerful in establishing individual relations among activities in the various data files.

An important unanswered question for this procedure and for other monitoring as well is the extent to which individuals can deal with the cognitive and emotional complexity of a procedure like dictionary

construction. The experience in the field test suggests that this might be possible given considerable experience with the primary, i.e. data access functions of the system. The prerequisites for the development of a doer-and-observer condition in inquirers seem to be first, more time with the system so that its use becomes familiar and relaxed, and second, more efficient use of that time so that use of the system becomes positively motivating. The students in the field test who did spend considerable time with it and who felt that their experience had been productive, were eager to continue. Others, however, whose time was more limited or who did not feel that they had had enough meaningful interaction with the substantive parts of the system, remained puzzled and confused by it. The field test experience suggests that primary information needs must be satisfied before higher order self-examination can occur. Further assessment and development of monitoring procedures will require more field testing of existing procedures with inquirers whose experience with the system permits such self-examination. The information derived from the present field test, implemented in a reliable machine system, would provide a setting in which inquirers could reach this level more readily, and in which further monitoring techniques could be explored.

REFERENCES

Ellis, Allan B.; Pincus, Margaret E.; and Yee, Patricia. (April 1968) "Getting a Guidance Machine to Understand English." *Project Report No. 14.* Cambridge, Massachusetts: Information System for Vocational Decisions, Harvard Graduate School of Education.

Ellis, Allan B.; and Wetherell, Charles S. (September 1966) "The Computer and Career Decisions." *Technical Memorandum No. 1.* Cambridge, Massachusetts: Information System for Vocational Decisions, Harvard Graduate School of Education.

Landy, Stephen. (1968) "The Known and The Measured: A Consideration of Certain Implicit Assumptions in Testing in the Light of Some Recent Additions to the Theory of Knowledge." Cambridge, Massachusetts: Harvard Graduate School of Education. (unpublished qualifying paper)

Shoben, Edward J. Jr. (1965) "Guidance: Remedial Function of Social Reconstruction?" In Mosher, Ralph; Carle, Richard F.; and Kehas, Chris D. *Guidance and Examination.* New York: Harcourt, Brace, and World.

Tiedeman, David V. *et al.* (1968) "Individual Comprehension of Epigenesis in the Development of Career Decision-Making." Proposal to the U. S. Office of Education. Cambridge, Massachusetts: Information System for Vocational Decisions.

Tiedeman, David V.; and O'Hara, Robert P. (1963) *Career Development: Choice and Adjustment.* New York: College Entrance Examination Board.